

**CLAIMS**

What is claimed is:

- 1     1.   A segmented labyrinth seal having a windback configuration formed  
2         around a rotatable shaft for preventing leakage of oil from a bearing  
3         housing, comprising:  
4             a first face and a second face;  
5             an exterior cylindrical surface and an interior cylindrical surface each  
6         extending between said first face and said second face;  
7             a thread pattern provided on said interior cylindrical surface  
8         selectively configured in a right-hand direction and a left-hand direction,  
9         said thread pattern providing the windback configuration;  
10         said thread pattern being formed of a plurality of profiled teeth, said  
11         plurality of profiled teeth having first sides, second sides, and connecting  
12         sides extending between said first sides and said second sides, wherein  
13         leading edges are formed where said first sides join said connecting sides  
14         and trailing edges are formed where said second sides join said  
15         connecting sides, said first sides and said second sides being slanted  
16         toward said first face, and a pressure drop is taken over said plurality of  
17         profiled teeth; and  
18         a channel tracing said thread pattern formed between said first sides  
19         and said second sides of adjacent teeth of said plurality of profiled teeth,  
20         said channel adapted to capture the oil from the bearing housing, and to  
21         return said oil to said bearing housing without the need for axial drain  
22         holes.
- 1     2.   A segmented labyrinth seal according to claim 1, wherein said first sides  
2         have a steeper incline with respect to said interior cylindrical surface than  
3         said second sides.
- 1     3.   A segmented labyrinth seal according to claim 2, wherein said first side  
2         and said second side respectively form first and second angles that are  
3         oblique with respect to said interior cylindrical surface, said first angle  
4         being greater than said second angle.

- 1 4. A segmented labyrinth seal according to claim 1, wherein said first face is  
2 adjacent the exterior of the bearing housing and the second face is  
3 adjacent the interior of the bearing housing, the pressure drop being from  
4 a higher pressure near said second face to a lower pressure near said  
5 first face which is divided over each tooth of said plurality of profiled teeth.
- 1 5. A segmented labyrinth seal according to claim 4, wherein said pressure  
2 drop is divided into various intermediate pressures between said adjacent  
3 teeth of said plurality of profiled teeth, wherein said intermediate  
4 pressures are highest near said second face.
- 1 6. A segmented labyrinth seal according to claim 1, wherein said thread  
2 pattern has said right-hand direction when the rotatable shaft is rotating  
3 clockwise when looking down the rotatable shaft toward the bearing  
4 housing and has a left-hand direction when the rotatable shaft is rotating  
5 counter-clockwise when looking down the rotatable shaft toward the  
6 bearing housing.
- 1 7. A segmented labyrinth seal according to claim 6, wherein said segmented  
2 labyrinth seal is formed from two half-circle shaped segments, said  
3 segments having first and second ends, said first ends abutting one  
4 another and said second ends abutting one another when said  
5 segmented labyrinth seal is assembled.
- 1 8. A segmented labyrinth seal according to claim 7, wherein said first and  
2 seconds ends of one of said two half-circle shaped segments are  
3 respectively provided with first and second split-line pins and said first and  
4 second ends of the other of said two half-circle shaped segments are  
5 respectively provided with first and second holes, said first hole receiving  
6 said first split-line pin and said second hole receiving said second split-  
7 line pin when said segmented labyrinth seal is assembled, and the  
8 position of said first hole and said first split-line pin is staggered in relation

9 to said second hole and said second split-line pin depending on said  
10 selective configuration of said thread pattern in said right-hand direction  
11 and said left-hand direction.

1 9. A segmented labyrinth seal according to claim 8, wherein at least one of  
2 said two half-circle shaped segments is provided with an anti-rotation pin,  
3 said anti-rotation pin being positioned at the apex of said at least one of  
4 said two half-circle shaped segments.

1 10. A segmented labyrinth seal according to claim 1, wherein said plurality of  
2 profiled teeth have a vertical tooth height, and said vertical tooth height is  
3 chosen to allow for a primary flow of said oil directed to said bearing  
4 housing in said channel.

1 11. A segmented labyrinth seal according to claim 10, wherein said vertical  
2 tooth height is chosen to prevent a secondary flow of said oil in an  
3 opposite direction to said primary flow in said channel.

1 12. A segmented labyrinth seal according to claim 11, wherein said vertical  
2 tooth height ranges from about 0.0625 to 0.1250 inches, and said plurality  
3 of profiled teeth have a radial clearance of about 0 to 3 mils from the  
4 rotatable shaft.

1 13. A segmented labyrinth seal having a windback configuration formed  
2 around a rotatable shaft for preventing leakage of oil from a bearing  
3 housing, comprising:  
4 a first face and a second face;  
5 an exterior cylindrical surface and an interior cylindrical surface  
6 extending between said first face and said second face;  
7 a thread pattern provided on said interior cylindrical surface  
8 selectively configured in a right-hand direction and a left-hand direction,  
9 said thread pattern providing the windback configuration;

10           said thread pattern being formed of a plurality of profiled teeth, said  
11           plurality of profiled teeth having first sides, second sides, and connecting  
12           sides extending between said first sides and said second sides, said  
13           plurality of profiled teeth having a vertical tooth height, and leading edges  
14           formed where said first sides join said connecting sides and trailing edges  
15           formed where said second sides join said connecting sides, said first  
16           sides and said second sides slanted toward said first face, wherein a  
17           pressure drop is taken over said plurality of profiled teeth, said pressure  
18           drop being from a higher pressure near said second face to a lower  
19           pressure near said first face; and

20           a channel tracing said thread pattern formed between said first sides  
21           and said second sides of adjacent teeth of said plurality of profiled teeth,  
22           said channel adapted for capturing the oil from the bearing housing, and  
23           returning said oil to said bearing housing without the need for axial drain  
24           holes, wherein said vertical tooth height of said plurality of profiled teeth  
25           prevents said pressure drop from having adverse effects on the  
26           performance of said segmented labyrinth seal.

1       14. A segmented labyrinth seal according to claim 13, wherein said pressure  
2       drop is divided into various intermediate pressures between said adjacent  
3       teeth of said plurality of profiled teeth, wherein said intermediate  
4       pressures are highest near said second face.

1       15. A segmented labyrinth seal according to claim 13, wherein said first sides  
2       have a steeper incline with respect to said interior cylindrical surface than  
3       said second sides.

1       16. A segmented labyrinth seal according to claim 15, wherein said first side  
2       and said second side respectively form first and second angles that are  
3       oblique with respect to said interior cylindrical surface, said first angle  
4       always greater than said second angle.

- 1 17. A segmented labyrinth seal according to claim 13, wherein said vertical  
2 tooth height of said plurality of profiled teeth is chosen to allow for a  
3 primary flow of said oil directed to the interior of the bearing housing in  
4 said channel.
- 1 18. A segmented labyrinth seal according to claim 13, wherein said vertical  
2 tooth height is chosen to prevent a secondary flow of said oil in an  
3 opposite direction to said primary flow.
- 1 19. A segmented labyrinth seal having a windback configuration formed  
2 around a rotatable shaft for preventing leakage of oil from a bearing  
3 housing, comprising:  
4 two half-circle shaped segments having first and second ends and  
5 forming a cylindrical shape, said first ends abutting one another and said  
6 second ends abutting one another when said two half-circle shaped  
7 segments are assembled to form the segmented labyrinth seal;  
8 an exterior cylindrical surface and an interior cylindrical surface, said  
9 exterior cylindrical surface and said interior cylindrical surface extending  
10 between a first face and a second face;  
11 a thread pattern provided on said interior cylindrical surface  
12 selectively configured in a right-hand direction when the rotatable shaft is  
13 rotating clockwise when looking down the rotatable shaft toward the  
14 bearing housing and in a left-hand direction when the rotatable shaft is  
15 rotating counter-clockwise when looking down the rotatable shaft toward  
16 the bearing housing;  
17 first and second split-line pins respectively located on said first and  
18 second ends of one of said two half-circle shaped segments, and first and  
19 second holes respectively provided on said first and second ends of the  
20 other of said two half-circle shaped segments, said first hole receiving  
21 said first split-line pin and said second hole receiving said second split-  
22 line pin when the segmented labyrinth seal is assembled, wherein the  
23 position of said first hole and said first split-line pin is staggered in relation  
24 to said second hole and said second split-line pin depending on said

25 selective configuration of said thread pattern in said right-hand direction  
26 and said left-hand direction;

27 said thread pattern being formed by a plurality of profiled teeth, said  
28 plurality of profiled teeth having first sides, second sides, and connecting  
29 sides extending between said first sides and said second sides, said  
30 plurality of profiled teeth having a vertical tooth height, and leading edges  
31 formed where said first sides join said connecting sides and trailing edges  
32 formed where said second sides join said connecting sides, said first  
33 sides and said second sides respectively forming first and second angles  
34 that are oblique with respect to said interior cylindrical surface, said first  
35 angle always being greater than said second angle, wherein a pressure  
36 drop is taken over said plurality of profiled teeth, said pressure drop being  
37 divided into various intermediate pressures between adjacent teeth of  
38 said plurality of profiled teeth; and

39 a channel tracing said thread pattern, said channel being wound in a  
40 direction opposite to the rotational direction of the rotatable shaft, said  
41 channel adapted for capturing the oil from said bearing housing, and  
42 returning said oil to said bearing housing without the need for axial drain  
43 holes, said vertical tooth height of said plurality of profiled teeth chosen to  
44 allow for a primary flow of said oil directed to said bearing housing in said  
45 channel, and to prevent secondary flow of said oil in an opposite direction  
46 to said primary flow in said channel.

- 1 20. A segmented labyrinth seal according to claim 19, wherein at least one of  
2 said two half-circle shaped segments is provided with an anti-rotation pin,  
3 said anti-rotation pin positioned at the apex of said at least one of said  
4 two half-circle shaped segments.